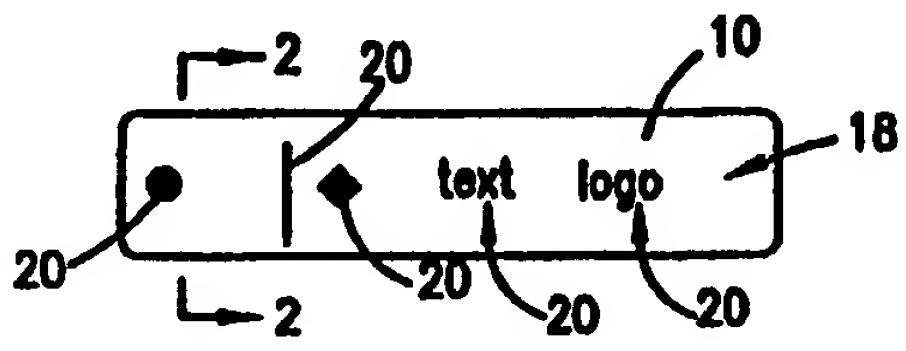




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : G01D 3/08, H04M 1/18	A1	(11) International Publication Number: WO 98/23920 (43) International Publication Date: 4 June 1998 (04.06.98)
(21) International Application Number: PCT/US97/21464 (22) International Filing Date: 21 November 1997 (21.11.97) (30) Priority Data: 08/756,111 25 November 1996 (25.11.96) US (71) Applicant: ERICSSON INC. [US/US]; 7001 Development Drive, P.O. Box 13969, Research Triangle Park, NC 27709 (US). (72) Inventor: SMITH, Stacy, N.; 305 Cottonwood Lane, Holly Springs, NC 27540 (US). (74) Agents: MOORE, Stanley, R. et al.; Jenkins & Gilchrist, P.C., Suite 3200, 1445 Ross Avenue, Dallas, TX 75202 (US).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: MOISTURE INDICATOR LABEL (57) Abstract <p>A label is provided having a substrate material with or without a pressure sensitive adhesive layer positioned on a back surface thereof and having a spot of water soluble ink applied to a front surface thereof. The label is placed within the interior of an electronic device, and thereafter used to identify in an objective manner, instances of moisture exposure. In the presence of moisture (arising perhaps due to the submersion of the device in water), the spot of ink smears, dissolves or bleeds. Multiple spots with differing solubility characteristics may be provided to assist in identifying the nature (e.g., time duration) of the moisture exposure.</p> 		

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-1-

MOISTURE INDICATOR LABEL

BACKGROUND OF THE INVENTION

Technical Field of the Invention

5 The present invention relates to the detection of moisture and, in particular, to the detection of moisture exposure to an electronic device.

Description of Related Art

10 Through neglect or accident, electronic devices are occasionally exposed to moisture. For example, a cellular telephone may accidentally be dropped by its owning subscriber into a body of water (such as a swimming pool or lake). Certain electrical components of the electronic device may be adversely affected by such moisture exposure, especially if the exposure is a submersion and lasts for a prolonged period of time. Not surprisingly, the electrical device often fails to thereafter operate properly, if at all. It is not then unusual for the owner to return the device for repair and allege a warranty-covered defect as the cause of the failure.

20 Typically, manufacturers' warranties do not cover electrical failure due to submersion types of moisture exposure. The owner is assisted, however, in asserting a fraudulent warranty claim related to a device failure because the cause of the failure (i.e., the moisture) has long since evaporated before the device is returned for repairs. In these cases, unless the owner admits to the moisture exposing incident, or some other indication of exposure is present, the manufacturer is left with little option but to repair or replace the device at its own cost. Of course, even when the repairman has suspicions, accusation of the owner of fraud without sufficient evidence of a moisture exposing incident is an unacceptable solution. There would be a great advantage then if some objective means could be provided for

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-2-

indicating when an electronic device has been subjected to unacceptable levels of moisture.

One known prior art solution to this need is to place a desiccant card, having an indicator that changes color with changes in relative humidity, inside the device. This solution is not particularly effective as the indicator responds to humidity changes, and thus, returns to normal with a return of the device to a low humidity environment. Thus, no permanent indication of excessive moisture exposure is provided. Furthermore, detection of a high humidity (as opposed to moisture submersion) condition is generally irrelevant as humidity does not normally adversely affect device operation. An alternative solution of providing a desiccant package is disfavored for the same reasons, as well as because installation of the package within the device may be difficult or too expensive.

SUMMARY OF THE INVENTION

To address the foregoing need, the present invention comprises a label made of an appropriate substrate material having a spot of water soluble ink disposed on a front side thereof. The label may be affixed to a surface of, or otherwise included within an electrical device. For example, the label may be affixed to a support frame of the device. If the device were thereafter exposed to moisture, such as a submersion in water, an irreversible distortion (e.g., a smearing, dissolution or bleeding) of the water soluble ink spot occurs leaving a visible objective indicating unacceptable exposure. The characteristics of the ink (i.e., its solubility) are selectively chosen such that acceptable levels of moisture exposure (from, for example, high humidity environments) would not cause any ink smearing, dissolution or bleeding on the substrate.

-3-

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the method and apparatus of the present invention may be acquired by
5 reference to the following Detailed Description when taken in conjunction with the accompanying Drawings wherein:

FIGURE 1 is a top view of a moisture indicator label of the present invention;

10 FIGURE 2 is a cross-sectional view of the moisture indicator label of the present invention taken along lines 2-2 of FIGURE 1; and

FIGURE 3 is an exploded perspective view of a cellular telephone illustrating the application of the moisture indicator label of the present invention to the
15 interior of an electronic device.

DETAILED DESCRIPTION OF THE DRAWINGS

Reference is now made in combination to FIGURES 1 and 2. FIGURE 1 is a top view of a moisture indicator label
20 10, and FIGURE 2 is a cross-sectional view of the moisture indicator label taken along lines 2-2 of FIGURE 1. The moisture indicator label 10 comprises a substrate material 12 made of appropriately sized sheet film, paper, cardstock or plastic. Affixed to the back side 14 of the
25 substrate material 12 in one embodiment is a thin layer 16 (thickness exaggerated in FIGURE 2 for clarity) of a pressure-sensitive adhesive. The adhesive used may be of any known kind, including any one of a number of commercial grade acrylic adhesives, but in any event,
30 should be carefully selected from those kinds of adhesives whose adhesive properties do not degrade when exposed to moisture. In another embodiment, no adhesive is applied to the back side 14. Affixed to a front side 18 of the substrate material 12 is at least one spot 20 (thickness
35 exaggerated in FIGURE 2 for clarity) of a water soluble ink. The use of the term "spot" is not meant to restrict the shape of the ink spot 20 to a dot or similar circular

-4-

shape. Rather, the term "spot" is meant to encompass circular, as well as non-circular shapes, and thus include lines, squares and other geometric configurations or designs (such as manufacturer logos or selected text) as permissible shapes for the ink spot 20. In some instances, the shape of the spot 20 may be advantageously selected to provide information in the event of an exposure to moisture as will be more fully-explained below. The ink used may be of any known water soluble kind including Colorcon No-Tox or commercial food inks. It will, of course, be understood that the permissible inks used in spot 20 include equivalent water soluble dyes as well. In accordance with its solubility characteristic, the ink spot 20 will irreversibly distort by smearing, dissolving or bleeding when exposed to moisture, thus providing an objective indication of exposure even if the moisture should thereafter evaporate and leave no other trace of exposure.

When desired, more than one spot 20 of ink may be applied to the front side 18 of the substrate material 12. In such cases, the plural included ink spots 20 may have differing solubility characteristics, as well as perhaps different shapes, and thus, react with an irreversible distortion (such as smearing, dissolving or bleeding) differently when exposed to moisture. This provides not only an objective indication of exposure to moisture, but also an objective indication of the nature of the exposure. For example, through the use of plural spots 20, having different time solubility characteristics and/or shapes, an indication of the length of time of the moisture exposure may be obtained. Alternatively, through the use of plural spots 20 having different moisture type solubility characteristics and/or shapes, an indication of the type of moisture to which the label 10 exposed may be obtained.

Reference is now made to FIGURE 3 wherein there is shown an exploded perspective view of an electronic device

-5-

30 comprising a cellular telephone. The device 30 includes a frame 32 supporting a plurality of electric circuit components (schematically illustrated at 34) mounted in one embodiment to a printed circuit board. In
5 another embodiment, the frame 32 also functions as a printed circuit board (or vice versa) obviating the need for a separate board. The device 30 further includes an enclosure 38 for enclosing the frame 32 and protecting the circuit components 34.

10 With reference additionally now again to FIGURES 1 and 2, in one embodiment the moisture indicator label 10 is affixed through the use of its pressure-sensitive adhesive layer 16 to a selected interior surface of the device 30. In another embodiment, an appropriate
15 mechanical retainer (like a slot, tab or clamp 44, or screw 46) is used to affix the label 10 within the device 30. As yet another alternative, the label need not be affixed within the device 30 at all. Although only one mounting position is necessary, plural potential mounting
20 positions for the label 10 are illustrated in FIGURE 3. In one implementation, the label 10 is mounted to an interior surface 40 of the enclosure 38. In another implementation, the label 10 is mounted to a surface 42 of the frame 32.

25 In the event the device 30 is thereafter exposed to moisture (perhaps due to a submersion in water), and assuming the moisture managed to enter the interior of the device, penetrating through the enclosure 38 and drenching the label 10, some degree of irreversible distortion (such
30 as a smearing, dissolution or bleeding) of the included water soluble ink spot 20 would occur, thus providing an objective indication of moisture exposure. A repairman, in view of this objective evidence, and perhaps other evidence, may then reasonably conclude that a device
35 failure was caused or exacerbated by unacceptable levels of moisture exposure.

-6-

Although a preferred embodiment of the method and apparatus of the present invention has been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it will be understood that the invention is not limited to the embodiment disclosed, but is capable of numerous rearrangements, modifications and substitutions without departing from the spirit of the invention as set forth and defined by the following claims.

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-7-

WHAT IS CLAIMED IS:

1. An electronic device, comprising:
an enclosure for enclosing electronic circuit components; and
5 a label placed within the enclosure, the label having applied to a top surface thereof a spot of water soluble ink that responds to a moisture exposure incident with an irreversible distortion thereof to provide an objective indication of such exposure.
- 10 2. The device as in claim 1 wherein the device comprises a cellular telephone.
3. The device as in claim 1 wherein the label is
15 affixed to an inner surface of the enclosure.
4. The device as in claim 1 wherein the label is affixed to a surface of a frame supporting the electronic circuit components.
- 20 5. The device as in claim 1 wherein the spot comprises a substantially circular shape.
6. The device as in claim 1 wherein the spot
25 comprises a line.
7. The device as in claim 1 wherein the spot comprises a logo design.
- 30 8. The device as in claim 1 wherein the spot comprises plural spots.
9. The device as in claim 8 wherein each one of the plural spots have a different solubility characteristic.
- 35 10. The device as in claim 1 wherein the spot comprises text.

-8-

11. The device as in claim 1 further including means for affixing the label within the enclosure.

5 12. The device as in claim 11 wherein the means for affixing comprises an adhesive.

13. The device as in claim 11 wherein the means for affixing comprises a screw.

10 14. The device as in claim 11 wherein the means for affixing comprises a slot into which the label is inserted.

15 15. A label for detecting exposure to moisture, comprising:

a sheet substrate having a front surface; and

20 a spot of water soluble ink applied to the front surface of the substrate, the spot responding to a moisture exposure incident with an irreversible distortion thereof to provide an objective indication of such exposure.

25 16. The label of claim 15 further including a pressure-sensitive adhesive mounted to a back surface thereof, and wherein the pressure-sensitive adhesive is selected from those kinds of adhesives whose adhesive properties do not degrade when exposed to moisture.

30 17. The label as in claim 15 wherein the spot comprises a substantially circular shape.

18. The label as in claim 15 wherein the spot comprises a line.

35 19. The label as in claim 15 wherein the spot comprises a logo design.

-9-

20. The label as in claim 15 wherein the spot comprises plural spots.

5 21. The label as in claim 20 wherein each one of the plural spots have a different solubility characteristic.

22. The label as in claim 15 wherein the spot comprises text.

1 / 1

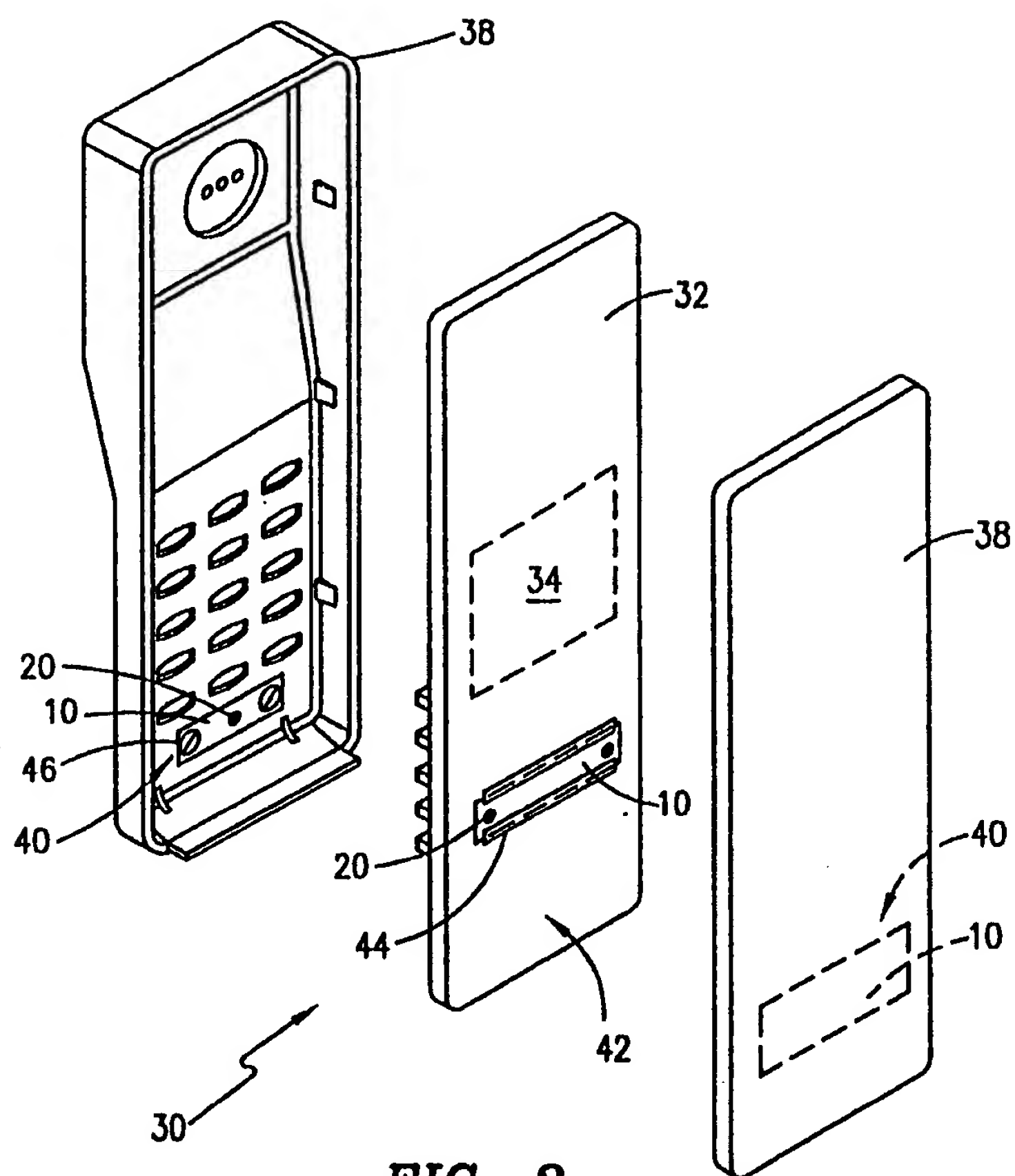


FIG. 3

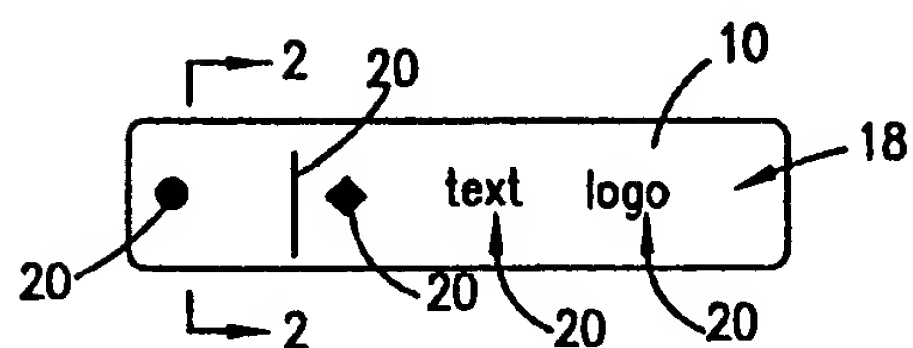


FIG. 1

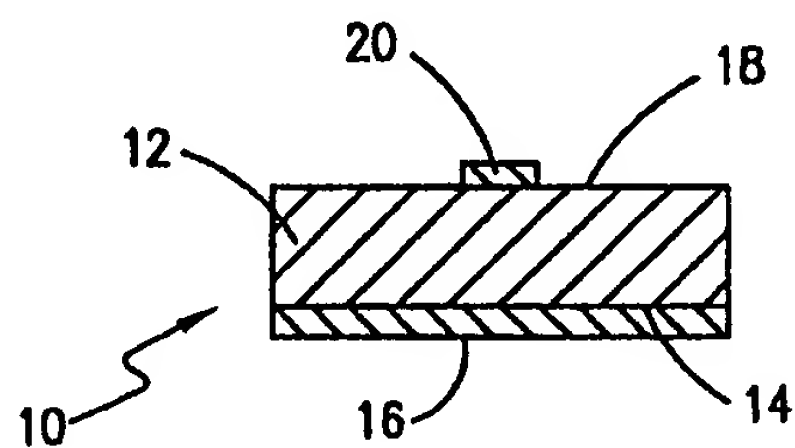


FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 97/21464

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G01D3/08 H04M1/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G01D H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>DATABASE WPI Section Ch, Week 9440 Derwent Publications Ltd., London, GB; Class A97, AN 94-322368 XP002057944 & JP 06 248 207 A (TOPPAN PRINTING CO LTD) , 6 September 1994 see abstract</p>	<p>1-8, 10-12, 16-20,22</p>
Y	<p>--- US 3 844 718 A (COHEN H) 29 October 1974 see the whole document</p>	<p>1-8, 10-12, 16-20,22</p>
Y	<p>--- GB 2 056 950 A (LINNICH PAPIER & KUNSTSTOFF) 25 March 1981 see the whole document</p>	<p>1-8, 10-12, 16-20,22</p>
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☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

6 March 1998

Date of mailing of the international search report

17/03/1998

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A	PATENT ABSTRACTS OF JAPAN vol. 095, no. 009, 31 October 1995 & JP 07 146241 A (TOPPAN PRINTING CO LTD), 6 June 1995, see abstract ---	1
A	PATENT ABSTRACTS OF JAPAN vol. 095, no. 007, 31 August 1995 ✓ & JP 07 098309 A (TOPPAN PRINTING CO LTD), 11 April 1995, see abstract -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3844718 A	29-10-74	CA 986828 A	06-04-76
GB 2056950 A	25-03-81	DE 2929582 A	05-02-81
		FR 2461662 A	06-02-81